The hybrid course: Merging on-line instruction and the traditional classroom

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The efficacy of on-line learning environments has received considerable attention in recent years. Generally, researchers have found little impact of virtual learning environments on learning outcomes. With a few exceptions, however, these studies have focused upon distance learning courses where students enter the course without expectations of significant amounts of face-to-face contact with the instructor(s). Information technology, and particularly Web-based multimedia, increasingly offers opportunities to transfer content delivery and other associated activities from face-to-face settings to on-line venues. However, in order for this transference of content and process to be effective in courses recognized as face-to-face courses, students must find the virtual environment appealing. They must also achieve learning outcomes at least as high as those achieved in traditional class settings. The research reported upon herein demonstrates the utility of on-line learning environments in traditional classes both as an efficient means for executing activities previously tethered to the classroom setting and as a means to allow the pursuit of higher levels of learning.

Keywords: hybrid course, distance education, distance learning, pedagogy, technology mediated learning, computer enhanced learning

1. Introduction and background

When one mentions the use of information technology, and particularly the Internet or World Wide Web, to deliver basic business course content, visions of distance education often leap to mind. Certainly, significant attention has been given to gauging the efficacy of computer mediated instruction in its many forms relative to distance education. Web-based distance courses and programs offer the promise of access to educational opportunities to individuals bound by time and geographic constraints. Furthermore, such instruction may generate increased revenues and reduce course-related costs for educational institutions. However, in *traditional* learning environments that are reliant upon the classroom meeting as the primary venue in which to deliver course content and facilitate learning, the application of computer-enhanced learning tools and techniques is far less explored. Often such resources are supplementary or auxiliary, consist of "practice" material, or offer a redundant repository of course materials.

While the aforementioned applications of information technology (hereafter "IT") to the teaching and learning processes of the traditional course are widely used and

heralded, they do not represent the use of IT as a *primary* means of content delivery in the traditional course. The research reported upon herein is aimed at determining the potential of IT as an effective alternative vehicle by which to perform some of the activities traditionally undertaken in the classroom setting, particularly content delivery. To the extent that such activities can be successfully transferred outside the physical classroom, valuable face-to-face class meeting time can be reallocated to more interactive learning activities with the intent of improving overall learning outcomes.

The application of IT toward broadened and/or deepened understanding of the subject matter of a course is increasingly relevant owing to the ever-expanding set of requirements recruiters set forth for newly minted undergraduate business students. Improved IT, communication and analytical skills, while talked about for years, are particularly highly prized in the competitive environments into which new graduates pass. Significantly complicating an ever expanding set of desired skills and attributes for new graduates, there typically exists a disparity between the set of skills and attributes sought by the college recruiter and those deemed most important by middle and upper management. Recruiters value highly those skill sets that can be of immediate use to the firm, e.g., database skills held by information systems and non-information systems graduates alike, current technical knowledge of the financial markets, accounting rules, and the like. Middle and upper level managers, on the other hand, commonly report that they can teach these skills the recruiters are using as a pre-filter for new hires. These managers report they prefer instead to find in new graduates polished written and oral presentation skills, well-honed analytical skills, and an appreciation for the overarching issues and trends in the functional areas of business. These dual demands present a particularly difficult issue given the limited amount of time associated with any given course. Simply, there is insufficient time in a traditional class setting to fully develop the skills sought by the recruiter (the so-called "immediately applicable skills") and those sought by middle and upper management (the so-called "career building skills").

The motivation for the research reported upon herein, then, is not to explore the potential of IT to democratize higher education by making instruction available to broader or more diverse sets of students. Neither is it to consider the ability of IT-based course offerings to generate additional revenue or reduce delivery costs for the institution. Quite separately, the present research targets the potential of IT to enable the instructor to *efficiently* and *effectively* broaden and deepen the learning process and outcomes for students of business. For the course upon which this research is based, face-to-face class meetings are not viewed as but yet another opportunity for straight unidirectional content delivery, i.e., lecture. Rather, in addition to active learning exercises, portions of class meeting time are applied toward content delivery, distillation and integration. Hence, a significant component of the value added to the course by the professor during class meetings is this role of adding to, culling, filtering and integrating course materials and concepts. Extant resources, whether academic or

practitioner, do not exist in adequate quantity, richness or form to obviate the need for instructors to perform this value-adding role.

Unfortunately, the completion of these activities leaves precious little, if any, time in which to develop a deeper or broader understanding of the field. The processes by which such an improved understanding would be developed require facilitation by the instructor. Hence the motivation for the present study. If the delivery, distillation and integration function performed by the instructor (and which *must* be performed by the instructor) in the face-to-face class meeting can be migrated to a virtual environment, then valuable class time can be liberated. The assumption herein is that time constraints on face-to-face meetings between the instructor and the class prevent the course from reaching its full potential. The motivation to pursue alternative IT-based teaching methods is not one of simply desiring to cover more material within a course. Rather, it is a belief that by introducing significant intellectually engaging active learning components, students achieve higher levels of learning. What must therefore be determined is whether the migration of selected instructor activities to a virtual environment is as effective as their execution in face-to-face settings. A further benefit of this migration to a virtual learning environment is the potential to support multiple learning styles among students, an issue discussed directly.

2. The application of information technology to business education

Leidner and Jarvenpaa [1] have noted that much of the extant research focused upon computer enhanced learning has addressed improvements in efficiency or effectiveness of instruction without fundamentally modifying the educational process. Indeed, several examples of such research exist (see, for example, [2–9]). Generally, these studies address the efficacy of computer mediation in the communication and collaboration activities within college courses. The utility of e-mail, list servs and threaded on-line discussions all have been considered.

Recently, researchers have begun to consider the role of learning style in effective teaching and learning processes. Curiously, within selected functional areas of business education (and indeed in disciplines outside business), national bodies are setting requisite levels of mastery to be demonstrated by graduates. This focus on standardized content, it is argued, leads to higher overall quality of learning outcomes. Yet, this standardization of content often is accompanied by a standardization of learning processes (again, with the purported intent of improving overall learning outcomes), this being at odds with a course strategy that includes supporting multiple learning styles [10–12].

Providing a variety of opportunities for challenging learning experiences that suit multiple learning styles can lead to improved learning outcomes. Borg and Shapiro [10] found that student performance improved if the Myers–Briggs Type Indicator (MBTI) category of the instructor matched that of the student. Research also has demonstrated that learning styles vary with a number of demographic variables [13]. This suggests, then, that if instructors are to give explicit consideration to the variety of

learning styles likely manifest in their students, they should be creating a collection of varied learning opportunities and/or modalities of content delivery in their courses.

There also exists a limited but compelling body of literature aimed at determining the efficacy of non-traditional, IT-based modes of content delivery and interpersonal interaction. Alavi, Yoo and Vogel [14], in an innovative use of IT to allow students at different universities to work collaboratively, find no significant difference in learning outcomes for students who had face-to-face learning experiences and those who learned in a video conferencing environment. Looking beyond video conferencing, the efficacy of distance education in general, as measured by exam grades, has been demonstrated in a number of studies (see, for example, [15,16]).

Drawing upon these prior findings, the present research is focused upon two distinct desired changes to an introductory management information systems course. First, within the context of a traditional face-to-face course, the effectiveness and efficiency of providing content in multiple IT-based modalities is explored. By providing course content in a variety of formats, students may select the format(s) that they determine are most effective for them. While prior research has explored the efficacy of such on-line learning resources, much of this research has focused upon distance learning environments. Students enrolling in such courses are aware from the outset that face-to-face interaction with the instructor(s) will be severely limited if present at all. Curiously, LaRose et al. [17] found that students involved in courses delivered via virtual classrooms did not perceive reduced teacher immediacy in the course. They did, however, complain of an inability to pay attention to on-line content delivery (perhaps owing to a lack of eye contact) and bemoaned the inability to get instant feedback for questions that occurred to them while working with on-line materials. What is not clear is whether students will respond favorably to on-line content delivery in a course that is perceived to be a face-to-face course. While previous studies have focused upon the relative comparisons of face-to-face and computer-mediated teaching and learning as measured by test scores [15], these studies generally are not examining a hybridized course in which face-to-face and remote communication between instructor and students are being interwoven. Lage et al. [18] have examined the efficacy of the hybridized course concept in an introductory economics course and found a positive student reaction. However, their study relied primarily upon student self-report data and relied upon simple descriptive statistics to determine efficacy. It remains unclear, then, when examined under a more rigorous empirical lens, whether students in a traditional face-to-face course setting will respond favorably to having significant components of the course (and, indeed, those components heretofore undertaken in face-to-face class meetings) executed on-line. Further, it is unclear whether students will perceive value in the addition of active learning exercises that depend upon these on-line learning experiences, particularly since these exercises represent a net increase in the total work load associated with the course.

3. Creating the hybrid course

3.1. The environment

The research reported upon herein was undertaken within the context of the core management information systems (MIS) course taught within the college of business at a prominent liberal arts university in the southeast. The course is required of all undergraduate business majors, all of whom are in their junior or senior year. No MIS degree is offered within the college of business so, by definition, all students in the study had as their primary area of interest a functional area other than MIS. Among students, the course historically has enjoyed a reputation of being difficult and challenging, yet rewarding and critically important to future success. Enrollment in courses is limited to twenty five students.

For those institutions engaged in computer-enhanced learning, student access to computing resources typically is of much concern. It is therefore appropriate to note that at the institution where this research was undertaken, a ubiquitous computing environment has been implemented. All students have a standard laptop computer issued by the university and further have ready access to the university network both on- and off-campus. Network reliability and server availability generally is outstanding, and user support is generous. While such an enviable computing environment eases the introduction of any computer-based pedagogical shift, it should be noted that such an environment was not crucial to the deployment of the IT-based course changes described herein.

3.2. Contents and modalities

As noted earlier, the principal motivation for exploring the hybridization of the conventional MIS course through the introduction of a virtual, or distance, learning component was the freeing of face-to-face class meeting time for the pursuit of broader and deeper coverage of relevant materials, and secondarily to provide course content in multiple modes. Toward that end, selected course content that previously was delivered and developed in class meetings was moved to an on-line venue. Specifically, this content was manifest in three distinct modalities:

1. "CyberShows" – At the core of the hybrid MIS course is a streamed audio-video presentation. This presentation is available to students at all times from both on-campus and off-campus locations via the course Web site. CyberShows consist of images of presentation graphics slides accompanied by an audio recording of the instructor (information concerning the actual technologies employed is presented in appendix A). Brief video clips also are interspersed throughout the CyberShows and are used to present brief interviews with practitioners, glimpses of actual computing facilities, and the like. The software application used to deliver the CyberShows enables self-paced progression through, and easy navigation within, the presentations. Presentations typically run twelve to fifteen minutes.

2. Scripts – The audio portion of the CyberShow is generated from a script written by the instructor. The script is available from the course Web site as an electronic word processing document. The text, organized to reflect the progression through the images and video of the CyberShow, reflects exactly the audio component of the on-line presentation.

3. Slides – The still images within the CyberShow are derived from presentation software slide images developed by the instructor. These images are available from the course Web site as an electronic presentation software file.

The CyberShows do not simply represent material that is found in a textbook or the practitioner press. Rather, they reflect strongly the value-adding nature of the instructor contribution discussed above. That which is presented in the CyberShows (and their associated scripts and slides) is nowhere else readily available in like form, style or integration.

Following completion of an assigned CyberShow but preceding the next class meeting, students are required to complete an on-line graded and timed quiz. Quizzes are timed in order to require students to more thoroughly absorb the material rather than simply looking for an answer in a printout of a CyberShow script, for example, without having actually assimilated the material. Simply, by instituting a tight time requirement for the quiz, there is insufficient time to search materials for an answer. Students receive immediate feedback regarding their performance on the quiz. Rather than being used as a robust assessment instrument, however, the quiz is intended to assure consumption of CyberShow content prior to the next class meeting; students receive 50% credit on a quiz simply for having taken the quiz, the remaining 50% being determined by the actual performance on the quiz. Overall performance on these quizzes over the course of the semester contributes only to one's participation grade which itself is worth only 15% of the overall course grade. These few points associated with a quiz did nonetheless prove a very effective means by which to entice students to complete the quizzes. Quiz grades below 80% were rarely encountered.

During the class meeting following completion of a CyberShow, students engage in a scenario-based analytical exercise. Lacking appropriate case study resources for the core MIS course, the author undertook with a cadre of information systems professionals, many of whom are senior executives, the development of a series of brief (2–3 pages) scenarios based upon actual recent events, decision situations and challenges facing their organizations relative to information systems and technology. These scenarios, dubbed "Real Wold Scenarios", draw upon the content of the recently completed CyberShow and are characterized by their inclusion (without explanation therein, though perhaps within other course materials) of the actual jargon and lexicon of the information systems arena. Furthermore, care was taken to build into the scenarios the true complexity of the situation, including political issues, competitive pressures, technological uncertainties, and the like. To fully develop these dimensions of the scenario easily could result in a case in excess of twenty pages. However, the intent for the scenarios is to foster discussion, debate and peer teaching. In this, the

scenarios leave important dimensions sufficiently ill-defined to force student interaction and further require the class collectively to make assumptions upon which they will base their analyses. For selected scenarios, the actual information systems professional with whom the scenario was developed assisted in the facilitation of the class meeting.

The learning outcome sought with the Real World Scenarios was to more fully develop an ability to grapple with the complexity of the actual environments in which new graduates must function. The intent decidedly was *not* for students to arrive at a firm recommendation for action relative to the scenarios. In fact, for many of the scenarios, the firms upon which the scenario was based either had yet to resolve the issues therein or required several months to adequately reach conclusions about actions to be taken. Students instead sought to surface the relevant issues, integrate those issues into a framework and then pose what they believe to be the most important questions that would require close analysis in order for the firm to arrive at a responsible decision. The outcome or status of the situation in the actual firm upon which the scenario was based was next revealed to the students. The final activity of the class meeting was a critical discourse surrounding the actions taken by the actual firm and how those compare and relate to the output and evaluation process that arose in the first part of the class meeting.

4. Assessment approach and method

4.1. Procedure

The present research occurred during the semester immediately following a semester during which a proof-of-concept study of the CyberShow and Real World Scenario concepts was undertaken. During the semester in which the research reported upon herein was undertaken (spring semester of 1999), the instructor taught two sections of the introductory core MIS course in back-to-back time slots. Students in both sections were aware the study was being performed. For administrative reasons, composition of the two sections of the course is beyond the control of the instructor. Consequently, subjects cannot truly be assigned randomly to treatment and control groups. Each section is effectively an intact group (a fact dealt with during the design and analysis phases of the study). Students register on-line for the section of the course they desire. However, which section was to be the treatment group was not determined until student registration was complete. Prior to the beginning of the semester, the instructor allowed an impartial third party to blindly select which section would use the CyberShows and Real World Scenarios and thus be the treatment group. The other section would be taught with the more conventional class meetings without CyberShows or Real World Scenarios. Both sections had access to the same absolute content, excepting the Real World Scenarios, and were given the same project assignments.

On the first day of class students were informed of the study and given the opportunity to switch to the other section, to select another professor for the course,

or to drop the course altogether. All students elected to remain in their original section assignments. Students in the control group were prevented from accessing the CyberShows via a password protection scheme on the course Web site that relied upon their university login ID, something they are most unlikely to divulge to other students since that ID also allows access to on-line information regarding grades and matriculation, as well as personal e-mail.

4.2. Operational measures

To avoid the confounding of the treatment effect, pretest data was gathered for both the control and treatment groups during the first week of the semester. Specifically, class year, age, and grade point average data were obtained from a survey at the beginning of the semester. Grade point averages were grouped into six categories ranging from 1.0 to 4.0 in increments of 0.5 points. Students in both the control and treatment groups also completed a survey in which they provided information regarding the extent of their prior experiences with information technology.

Students also completed a Web-based Keirsey Character Sorter survey. This survey was employed as a more concise approach to obtaining data traditionally associated with the Myers–Briggs Type Indicator instrument. The Keirsey instrument was used principally to obtain data on a student's preferred method of processing information. For this, the SN scale which focuses upon the distinction between sensing and intuition was used. Though a thorough description of the SN scale can be found in Myers [19], this scale essentially determines one's preferred perceptive process; sensing types prefer precise and routine tasks while intuitive types prefer new and imprecise tasks.

As suggested earlier, in order for the Real World Scenarios to be meaningful learning experiences, the CyberShows (and scripts and slides) must afford efficacious learning experiences. As noted earlier, students in the control group and treatment groups were exposed to the same content and instructor contributions to filtering, integration and the like. Therefore, success of the CyberShows must be gauged partly by the extent to which students in the treatment group achieved learning outcomes for this content at least as good as those students in the control group. Student achievement was therefore assessed using exam grades and project grade as a proxy measure. Identical exams were administered to both sections in print form during a regular class meeting and were administered to both the control and treatment groups on the same date. Exams consisted primarily of free response questions. It should be noted that, in the interest of ethical treatment of the control group, the exams did not draw upon content addressed in the Real World Scenarios. The author felt it important that students in the control group not perceive, to the extent possible, that they were disadvantaged in any way. To avoid any bias in the grading process, student identity was hidden on all material submitted for grading. Submitted materials from the control and treatment groups also were combined and shuffled to prevent the possibility of biasing the grading process.

An exit survey was administered on the final day of class. Four items were used to capture student perceptions of the utility of the CyberShows and associated scripts and slides. Three items asked students to rate the utility of the CyberShow, the script and the slides individually. The fourth item asked students to rate the extent to which they believed the CyberShows (and related resources) were effective learning tools. Each of the four items used a 5-point Likert-type scale. This same survey asked a series of questions related to perceived utility of the Real World Scenarios.

Finally, teaching evaluation surveys were administered on the final day of class. These surveys are required by the college of business and consist of ten items that use a 5-point Likert-type scale as well as three free response items intended to solicit information on the aspects of the course most liked and least liked by the student. Owing to college policy, responses to the teaching evaluation surveys cannot be tied to individual student identity. Only summary statistics are available.

4.3. Respondents

A total of 50 students were involved in the study. Twenty six students comprised the treatment group while 24 students comprised the control group (enrollment in the treatment group exceeded the 25 person limit owing to an exceptional situation with one student). Student demographic data is shown in table 1. Chi square analysis revealed no significant differences in the class year, gender, age, and grade point average distributions between the treatment and control groups.

4.4. Analyses

Analysis of covariance (ANCOVA) was used to determine the relative efficacy of the on-line learning resources (CyberShows, scripts, slides and on-line quizzes) compared to the traditional classroom experience. Because random assignment of subjects was not possible, analysis of covariance was used to reduce bias [20]. The technique also mitigates the impact of pre-existing differences on multiple independent variables by allowing their introduction as covariates [21]. Such differences were suspected in the control and treatment groups. The use of analysis of covariance in studies aimed at exploring the efficacy of different teaching techniques has been recommended [21] and used in several studies (see, for example, [4,22]). Huitema [23] has provided a heuristic for determining the maximum number of covariates in an analysis of covariance. For the present study, applying this heuristic results in a recommended maximum of three covariates. Because there existed four independent variables that were potential significant covariates, two separate series of analyses were performed. The first series of analyses used prior experience with information technology, gender and SN category as covariates. The second series replaced the least significant of these covariates, prior IT experience, with grade point average. In a separate analysis, a series of *t*-tests were performed on a summative measure that captures self-reported learning effectiveness of Real World Scenarios to determine

Table 1
Student demographic data.

	Treatment group			Control group			Total		
	Frequency	Percent	Cumulative percent	Frequency	Percent	Cumulative percent	Frequency	Percent	Cumulative percent
Class:									
Junior	23	88.5	88.5	20	83.3	83.3	43	86.0	86.0
Senior	3	11.5	100.0	4	16.7	100.0	7	14.0	100.0
Age:									
20	15	57.7	57.7	13	54.2	54.2	28	56.0	56.0
21	11	42.3	100.0	11	45.8	100.0	22	44.0	100.0
Gender:									
Male	13	50.0	50.0	13	54.2	54.2	26	52.0	52.0
Female	13	50.0	100.0	11	45.8	100.0	24	48.0	100.0
Grade point average:									
1.0–1.49	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.5–1.99	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0–2.49	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5–2.99	13	50.0	50.0	12.0	50.0	50.0	25.0	50.0	50.0
3.0–3.49	10	38.5	88.5	8.0	33.3	83.3	18.0	36.0	86.0
3.5–4.0	3	11.5	100.0	4.0	16.7	100.0	7.0	14.0	100.0

whether this construct is related to any of the covariates used in the analyses of covariance. Results of these analyses are discussed below.

5. Findings and discussion

5.1. Efficacy of the virtual learning environment

In an exit survey, students provided feedback on their perceptions of the value of the CyberShows, scripts and slides, as well as the extent to which the overall CyberShow concept contributed to their learning outcomes in the course. Presented in table 2 are the summarized responses to these survey items.

These statistics suggest students found the CyberShow materials of significant value. Indeed, more than three quarters of students in the treatment group either strongly agreed or agreed that the CyberShows and the scripts were important learning resources. It is not surprising that so many students found the slides themselves of lesser importance; these slides lack much of the information that is contained in the scripts and audio component of the CyberShows. One hundred percent of students found use of the overall CyberShow set of resources a useful learning experience.

To more rigorously explore the efficacy of the CyberShow concept, an ANCOVA analysis was performed for each of the three exams administered during the semester. ANCOVA results with prior IT experience, gender and SN category as covariates (see table 3) indicate no significant main effect on learning outcomes for the first or second

Table 2
Exit survey responses: Perceived usefulness of CyberShow resources.

		Frequency	Percent	Cumulative percent
Item:	The CyberShow alone was a useful learning and study resource.			
	Strongly agree	9	34.6	34.6
	Agree	13	50.0	84.6
	Somewhat agree	4	15.4	100.0
	Disagree	0	0.0	100.0
	Strongly disagree	0	0.0	100.0
Item:	The script alone was a useful learning and study resource.			
	Strongly agree	15	62.5	62.5
	Agree	4	16.7	79.2
	Somewhat agree	4	16.7	95.8
	Disagree	1	4.2	100.0
	Strongly disagree	0	0.0	100.0
Item:	The slides alone were a useful learning and study resource.			
	Strongly agree	8	30.8	30.8
	Agree	5	19.2	50.0
	Somewhat agree	8	30.8	80.8
	Disagree	5	19.2	100.0
	Strongly disagree	0	0.0	100.0
Item:	Collectively, the CyberShow materials were a useful learning and study resource.			
	Strongly agree	14	53.8	53.8
	Agree	12	46.2	100.0
	Somewhat agree	0	0.0	100.0
	Disagree	0	0.0	100.0
	Strongly disagree	0	0.0	100.0

exam. The overall ANCOVA for the third exam is significant owing to a significant covariance effect for gender. However, no main effect is seen for treatment. When prior IT experience is removed as a covariate and replaced with grade point average, the overall ANCOVA analyses for each of the three exams is significant (see table 4). However, no main effect for treatment on any of the three exam grades is seen. Generally, gender and grade point average have significant covariance effects. Results of the ANCOVA analysis, then, are consistent with earlier distance learning research on the efficacy of computer-mediated learning in which learning outcomes are achieved in a virtual environment rival those achieved in more traditional settings.

It should be noted that CyberShows were used most heavily (twelve lengthy CyberShows) by the treatment group during the segment of the course leading to the first exam, and to a lesser extent (four less lengthy CyberShows) leading to the third

Table 3
Results of analysis of covariance: The impact of CyberShows on learning outcomes.

	Exam 1			
	SS	*df*	*F*	*Sig.*
Model	148.6	4	1.745	0.157
Covariates:				
Prior IT experience	27.250	1	1.279	0.264
Gender	3.657	1	0.172	0.681
SN type	47.077	1	2.210	0.144
Main effect: Treament	48.112	1	2.258	0.140
Error	958.656	45		
Total	381126.7	50		
	Exam 2			
	SS	*df*	*F*	*Sig.*
Model	165.445	4	1.102	0.367
Covariates:				
Prior IT experience	13.511	1	0.360	0.551
Gender	41.591	1	1.108	0.298
SN type	81.588	1	2.174	0.147
Main effect: Treament	14.598	1	0.389	0.536
Error	1688.66	45		
Total	364082.3	50		
	Exam 3			
	SS	*df*	*F*	*Sig.*
Model	666.984	4	3.380	0.017
Covariates:				
Prior IT experience	28.953	1	0.587	0.448
Gender	341.047	1	6.914	0.012
SN type	195.807	1	3.969	0.052
Main effect: Treament	33.865	1	0.686	0.412
Error	2219.84	45		
Total	337923.4	50		

exam. During the segment of time between the first and second exam, however, no CyberShows were used, this owing primarily to other factors driving the course during that time frame. Consequently, course content and activity was identical for both the treatment and control groups leading to the second exam.

This discontinuity of CyberShow use by the treatment group may illuminate an unexpected outcome relative to a comparison of exam grades between the treatment and control groups. Levene's test for equality of variances indicates a significant difference

Table 4
Results of analysis of covariance: The impact of CyberShows on learning outcomes (*with grade point average introduced as covariate*).

	Exam 1			
	SS	*df*	*F*	*Sig.*
Model	239.394	4	3.103	0.024
Covariates:				
GPA	117.964	1	6.116	0.017
Gender	7.080	1	0.367	0.548
SN type	44.322	1	2.298	0.137
Main effect: Treament	37.804	1	1.960	0.168
Error	867.942	45		
Total	381126.7	50		
	Exam 2			
	SS	*df*	*F*	*Sig.*
Model	554.562	4	4.801	0.003
Covariates:				
GPA	402.627	1	13.942	0.001
Gender	65.309	1	2.262	0.140
SN type	33.123	1	1.147	0.290
Main effect: Treament	23.445	1	0.812	0.372
Error	1299.539	45		
Total	364082.2	50		
	Exam 3			
	SS	*df*	*F*	*Sig.*
Model	1333.368	4	9.656	0.000
Covariates:				
GPA	695.337	1	20.142	0.000
Gender	415.571	1	12.038	0.001
SN type	141.622	1	4.102	0.049
Main effect: Treament	26.452	1	0.766	0.386
Error	1553.454	45		
Total	337923.4	50		

in the distribution of grades between the treatment and control groups for the first exam ($F = 10.263$, $p = 0.002$). A significant difference in exam grade distribution variance was not found for the second exam ($F = 0.025$, $p = 0.875$) or the third exam ($F = 0.222$, $p = 0.640$). A free response item on the exit survey administered to subjects in the treatment group clearly indicated that students accessed the CyberShows (and related materials) repeatedly. Furthermore, as already noted, these students had access to the same content in multiple modalities. It appears possible that through

Table 5
Results of analysis of covariance:
The impact of CyberShows on database project performance.

	SS	*df*	*F*	*Sig.*
Model	125.622	4	4.133	0.013
Covariates:				
GPA	0.870	1	0.115	0.738
Gender	23.320	1	3.727	0.067
SN type	21.185	1	2.788	0.110
Main effect: Treament	48.934	1	6.440	0.019
Error	159.568	45		
Total	207604.1	50		

elective iterative exposure to course materials, exam grade distribution may have been tightened, implying that weaker students may have discovered an effective means by which to achieve improved learning outcomes relative to those they realize in more traditional course environments.

Students in both the treatment and control groups also were required to complete a lengthy and challenging database development project using a popular relational database product. The content and process associated with the CyberShow course materials was not associated with this project. Yet, with a liberal alpha value ($\alpha = 0.1$), significance was found in an overall ANCOVA with overall project grade serving as the independent variable, as well as for the main effect of treatment on student project performance (see table 5).

Anecdotally, it was noted that, as the semester progressed, students in the treatment group exhibited greater ease with computing technology. The completed database projects of these students demonstrated a greater depth of exploration with the database software used. Historically, students are reluctant if not fearful to explore the numerous features of this software that are not addressed explicitly by the instructor. Yet students in the treatment group clearly ventured beyond those features for which explicit training had been provided while students in the control group did not. Because a strict grading template for the project had been distributed to students at the beginning of the semester and that template did not expressly place a high value on such exploration and discovery, final project grades do not adequately capture this effect. Nonetheless, when viewing the final products of the project, the casual observer would recognize immediately a significantly higher level of accomplishment by students in the treatment group than those in the control group.

Use of the CyberShows relied upon student use of unfamiliar software. Acceptable performance in the class was contingent upon the student becoming sufficiently comfortable with the technology to use it as a learning tool. Through this process of adaptation, students in the treatment group may have developed a level of comfort with computing technology that assuaged their fears and apprehension when they began to explore the complex features of the database software they employed in their projects.

Additionally, students in the treatment group necessarily spent significantly more time using their computers in the context of the course. This omnipresence may effectively have created more opportunities for students to easily access and continue to work on their database projects. This finding points to opportunities for further research.

5.2. *Efficacy of the active learning exercises*

As described earlier, during the class meeting following a CyberShow assignment, students participated in an active, collaborative learning exercise in which they grappled with a Real World Scenario. This activity typically required thirty to forty minutes of class time. Through an exit survey, students provided feedback on their perceptions of the Real World Scenarios. Presented in table 6 are the summarized responses to these survey items.

These statistics suggest general approval of the Real World Scenarios, although support for them is not nearly as strong as for the CyberShows. Given the high degree of complexity and difficulty associated with the scenarios, one might conveniently conclude that students predictably prefer more straightforward course activities in which content is delivered to them and they, in turn, demonstrate mastery of that material by

Table 6
Exit survey responses: Perceived usefulness of Real World Scenarios (*selected items*).

		Frequency	Percent	Cumulative percent
Item:	Collectively, the Real World Scenarios were useful learning experiences.			
	Strongly agree	8	30.8	30.8
	Agree	8	30.8	61.5
	Somewhat agree	6	23.1	84.6
	Disagree	3	11.5	96.2
	Strongly disagree	1	3.8	100.0
Item:	The Real World Scenarios helped me understand the "real world" of information systems.			
	Strongly agree	10	38.5	38.5
	Agree	11	42.3	80.8
	Somewhat agree	3	11.5	92.3
	Disagree	1	3.8	96.2
	Strongly disagree	1	3.8	100.0
Item:	I believe that using CyberShows to free up class time for the express purpose of being able to do Real World Scenarios is a good idea.			
	Strongly agree	10	38.5	38.5
	Agree	7	26.9	65.4
	Somewhat agree	2	7.7	73.1
	Disagree	5	19.2	92.3
	Strongly disagree	2	7.7	100.0

Table 7
Exit survey items comprising summative measure for "Self-reported learning effectiveness of Real World Scenarios".

Item:	The Real World Scenarios were beneficial to me.
Item:	I would have liked to have spent more time with Real World Scenarios.
Item:	The Real World Scenarios helped me understand the "real world" of information systems.
Item:	I would have liked to have had more Real World Scenarios.
Item:	I believe that using CyberShows for the express purpose of freeing up class time to do Real World Scenarios is a good idea.
Item:	My ability to read, listen to and speak the management/information technology lexicon was improved by the Real World Scenarios.

Table 8
t-test for equality of means between students in sensing and intuition categories (based upon SN trait) for "Self-reported learning effectiveness of Real World Scenarios".

t	Sig. (2-tailed)	Mean difference
2.386	0.027	5.5167

regurgitating it on an exam. No formal effort was made to gauge student motivation. However, based upon his interactions with and observations of the students in both the treatment and control groups, the author regarded them as highly motivated and in possession of much native curiosity. Given this, a preference for less rigorous class experiences seemed an unlikely explanation for the moderate approval of the Real World Scenarios.

A closer examination of these data was undertaken. A factor analysis with varimax rotation was performed on exit survey items aimed at soliciting feedback on the scenarios, followed by a reliability test. Results of the analysis suggested the presence of a single factor composed of six items. This factor was labeled "self-reported learning effectiveness of Real World Scenarios" ($\alpha = 0.92$). A summative variable was created for this construct. Individual items that comprise the construct are presented in table 7. To more closely examine possible explanations for a level of enthusiasm associated with the scenarios that was less than that expected, a t-test for equality of means of this construct between students in each of the two categories of the Sensing/Intuition (SN) trait was performed. The results are telling (see table 8).

Those students characterized as preferring an intuitive approach to problem solving report higher satisfaction with the Real World Scenario learning experience. These individuals tend to look beyond the given facts to consider the "big picture" [19]. Those individuals preferring a "sensing" approach to problem solving attempt to apply already learned principles to the set of facts provided to them. As noted earlier, the Real World Scenarios depict highly complex situations and are characterized by an absence of important pieces of information (designed to mimic reality and foster dis-

cussion in the class meeting). It seems reasonable that those individuals who approach such situations from an intuitive perspective will be more comfortable and, indeed, successful at arriving at meaningful conclusions.

This discovery does, however, raise the question, while the CyberShows may be supporting multiple learning styles, have we now introduced a set of active learning exercises that are suitable only to a subset of students? Most likely, yes. However, a multitude of decision situations new graduates will face will be similarly ill-structured, complex and lacking important information. Developing the skills necessary to effectively perform in such situations, whether inherently amenable to one's innate tendencies or not, is an important goal. The results described above do, however, suggest the possible need to identify students that are likely to be uncomfortable in such situations and work to develop in them the skills necessary to adequately perform in ill-structured situations.

5.3. Course evaluation data

As noted, data obtained from standardized course evaluation instruments is not traceable to individual student subjects, limiting its usefulness in statistical analyses. However, the author's evaluations for the treatment and control classes were quite high and nearly identical. It was apparent that any statistical analysis would identify no significant differences between the treatment and control groups.

6. Lessons learned

The approach to pedagogy reported upon herein differs from both traditional face-to-face education and distance education. It is, instead, a blending of these two distinctly different approaches to providing education. The intent is to utilize IT to deliver content that otherwise must be presented in a face-to-face environment owing to its lack of availability in other formats. The result is the liberation of class meeting time for the pursuit of interactive learning exercises aimed at student achievement of higher levels of learning outcomes as described by Bloom [24] and others. In exploring the potential of the approach described herein, several lessons and guidelines became apparent:

- Information technology can lead to indirect improvements in learning outcomes. While the CyberShow concept did not precipitate improved (or decreased) exam performance, it did free time to engage in in-class active learning exercises built around the Real World Scenarios. While empirical data was not captured on the learning outcomes of these activities, the author was impressed with the progressively improving ability of students generally to grapple with complex realistic scenarios, suggestive of the attainment of higher levels of learning as described by Kolb [25]. This skill set otherwise would not have been developed within the course.

- Transferring selected content presentation (as well as filtering, integration, etc.) activities to an on-line venue can improve overall course efficiency. The intent and outcome of the use of CyberShows and Real World Scenarios was not to reduce financial or time resources applied to the course. In fact, the course now requires more time to administer. However, this increase in time required is perhaps ten to fifteen percent. The breadth and depth of coverage of relevant material, however, has increased far more. The utility of creating opportunities for students to experience more complex learning situations produces more marketable and valuable graduates. This is accomplished with only moderate increases in the time required of students in the course. Indeed, not a single student complained of the additional work load involved with the treatment class.
- Students learn in different ways and instructors teach in different ways. Information technology offers tools and techniques that allow instructors to efficiently provide course content in multiple modes. In so doing, the instructor allows the student to explore and acquire new information in ways that most suit them individually. Such technologies then, may mitigate the impact of an instructor's teaching style on learning outcomes. Of course, IT is not a remedy or panacea for inadequate performance in the classroom. However, coupled with a spirit and dedication to continuous improvement in and outside the classroom, it can enhance a course that already is adequately executed. Furthermore, it likely is not desirable always to match course activities to the individual attributes of students. Upon graduation, students will not operate in environments that adapt to their cognitive needs or preferences. Instructors may, therefore, elect to provide multiple delivery modes for core course content with which the student must quickly develop competency and then use a variety of learning experiences to develop cognitive flexibility during class meetings.
- Owing to the significant time required to develop on-line resources, instructors will want to consider engaging in such development activities only for that content that has a reasonably long "shelf life". If the content is likely to require significant modification or enhancement on a semesterly or annual basis, it likely is a poor candidate for multimedia development such as that described herein. We would not write a textbook for a course with the expectation that the book will be useful but for a single year. In the same spirit, advanced IT-based resources, when developed in-house, must remain viable for longer periods of time.
- The skill set required of the instructor pursuing the type of computer enhanced education described herein is expanded from that often applied to introductory courses. Further, while the extent of preparation required for class meetings is decreased, overall instructor-student interaction increases significantly. For some instructors, this may represent a shift in pedagogical philosophy, with a move away from the "sage on the stage" model toward the "guide on the side" model in which students maintain the pace of class interactions, the instructor serving to maintain the direction of the discourse and assure proper rigor therein.

7. Summary and conclusions

The course innovation described in this study demonstrates an efficacious technique for blending elements of the traditional classroom setting with elements of distance education. The most immediate outcome of this new course model has been a significantly increased ability to engage students in particularly rich classroom interactions. This is made possible not only by the time made available by transferring elements of the traditional classroom to an on-line environment, but also by higher levels of preparedness coming into class meetings. The use of on-line timed and graded quizzes has proven a sufficient enticement to students to work diligently prior to class meetings, thereby enabling in-class scenario-based exercises.

There have appeared on the market very recently tools that allow the easy creation of on-line presentations. As these products become more prevalent and understood by members of academe, it seems likely that increasing numbers of faculty will explore the potential of IT to liberate valuable class time. Insufficient time to engage in such activities seems an ever present complaint by members of business school faculties. Efficient solutions may at last be at hand.

Finally, by relying upon information technology for what were previously in-class activities, the diverse learning styles of students may be addressed. Combining multiple modalities of on-line content with a *pot pouri* of in-class learning exercises that appeal to a number of learning styles may precipitate higher overall learning outcomes.

Appendix A

A multi-step process was used to create the on-line CyberShows described in the body of the paper:

1. PowerPoint slides were created and then “Saved as HTML”. This creates several separate files, including an HTML file and a .gif file for every slide.
2. Only the .gif files created in Step 1 are used; all other files are deleted. The .gif files (one for each slide) are placed on the Web server.
3. A script is written in Microsoft Word. Care must be taken when writing the script since the written word often does not translate well to the spoken word.
4. The audio portion of the CyberShow is recorded by reading the script as one’s voice is captured by sound editing software. SoundForge is used for this process. A separate .wav file is created for each slide/.gif image.
5. Once all sound files have been recorded, each is processed into a file format that can be streamed. Real Producer (a product of RealNetworks) is used for this process in which a separate .rm file is created for each slide/.gif image. These sound files are transferred to a Real G2 server.

6. All image and audio files have now been created. A .smil file is then created that relates and synchronizes the image and audio files. This is a simple text file, also put on the Web server.
7. A link to the .smil file from the course Web site is created.

To include video clips, one simply references them in the .smil file in the same way that the .gif images are referenced. To view the CyberShows, students install the free Real G2 player on their personal laptop computers.

Links were also provided to the script (in .doc format) and the slides (in .ppt format).

The on-line quizzes described in the body of the paper were created using Macro-Media director. While a commercial course management product was available, the use of Director afforded more control over the security and timing features of the quizzes. To access the quizzes, students install the free Shockwave viewer on their personal laptop computers.

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